

# NASA TECH BRIEF

## *Lewis Research Center*



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### High Solar Intensity Radiometer

Silicon solar cells operated in a photoconductive mode can function as accurate, inexpensive, high solar intensity radiometers. Cells operated in this mode have been used to measure radiation intensities to  $2800 \text{ mW/cm}^2$  (20 solar constants). Output is linear with intensity level, highly stable and reproducible. Response time is very fast. The device is small and rugged.

Silicon solar cells are frequently used to measure visible radiant energy. Generally, the cells are operated in the photovoltaic mode and the short circuit current is the measured variable used to correlate the radiation intensity level. Utilizing the solar cell in this manner requires the assumption that the short circuit current approximates the light generated current which is really the parameter that varies linearly with intensity level. This assumption is usually valid for intensity levels up to approximately  $450 \text{ mW/cm}^2$  (3 solar constants). Above this level, the short circuit current is no longer linear with the intensity level due to internal resistance in the cells, high currents encountered, and surface temperature effects.

The linear operating range of silicon solar cell radiometers can be substantially extended by operating the cells in the photoconductive mode, rather than the photovoltaic mode. To achieve this, the cell is biased with a negative voltage of approximately one volt and the circuit current measured. This current closely approximates the light-generated current and is directly proportional to the radiation intensity. Tests have established the linear relation of the cell current to the radiation intensity over the complete intensity range

from 70 to  $2800 \text{ mW/cm}^2$  ( $\frac{1}{2}$  to 20 solar constants). Also, the cell current in the photoconductive mode is relatively insensitive to temperature changes.

In principle, silicon solar cells operated photoconductively would appear suitable for use as high-intensity solar radiometers for intensity levels much higher than 20 solar constants. Future investigations are planned for up to a 100 solar constant level.

#### Notes:

1. The following documentation may be obtained from:  
National Technical Information Service  
Springfield, Virginia 22151  
Single document price \$3.00  
(or microfiche \$0.95)

Reference: NASA TMX-2412 (N72-10397)  
Silicon Solar Cell As A High-Solar-Intensity Radiometer

2. Technical questions may be directed to:  
Technology Utilization Officer  
Lewis Research Center  
21000 Brookpark Road  
Cleveland, Ohio 44135  
Reference: B72-10130

#### Patent status:

No patent action is contemplated by NASA.

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